

Table 1. Chemical Compositions of Alloys

Alloy	Al %	Mn %	Zn %	Ca %	Sr %	RE %	Si %	Fe %	Ni %	Cu %	Be %	Zr %
Example1	4.8	0.26	0.15	0.25	1.35	0.08	0.01	0.003	0.0007	0.0005	0.0003	-
Example2	5.3	0.30	0.10	0.20	0.80	0.10	0.01	0.003	0.0006	0.0014	0.0004	-
Example3	6.1	0.25	0.40	0.20	0.90	0.20	0.01	0.003	0.0002	0.0012	0.0003	-
Example4	5.3	0.30	0.35	0.22	1.18	0.49	0.01	0.001	0.0005	0.0011	-	-
Example5	7.0	0.32	0.14	0.53	0.46	0.15	0.01	0.001	0.0008	0.0011	-	-
Example6	6.9	0.28	0.62	0.52	0.48	0.18	0.01	0.001	0.0007	0.0008	0.0004	-
Example7	7.9	0.12	0.12	0.66	0.52	0.12	0.01	0.001	0.0009	0.0011	-	0.01
Example8	7.9	0.31	0.64	0.68	0.55	0.16	0.01	0.002	0.0008	0.0016	-	-
Example9	8.8	0.24	0.11	0.85	0.51	0.03	0.01	0.001	0.0009	0.0014	-	-
Example10	8.5	0.28	0.72	0.95	0.25	0.08	0.01	0.002	0.0008	0.0017	-	-
Example11	8.7	0.07	0.15	0.85	0.15	0.24	0.01	0.001	0.0009	0.0012	-	0.01
Example12	8.9	0.18	0.48	0.65	0.05	0.75	0.01	0.002	0.0010	0.0009	0.0003	-
Example13	8.4	0.22	0.05	1.05	0.28	0.05	0.01	0.001	0.0008	0.0011	-	-
Example14	9.1	0.22	0.60	0.80	0.55	0.06	0.01	0.001	0.0008	0.0021	-	-
Comparative Example1	8.9	0.23	0.74	-	-	-	0.01	0.003	0.0007	0.0009	0.0009	-
Comparative Example2	4.3	0.29	0.01	-	-	2.4	0.01	0.003	0.0008	0.0008	0.0008	-
Comparative Example3	4.4	0.31	0.05	1.4	0.1	0.25	0.01	0.003	0.0006	0.0011	0.0009	-
Comparative Example4	9.4	0.19	0.54	1.3	0.45	0.05	0.01	0.002	0.0008	0.0012	0.0007	-
Comparative Example5	8.1	0.24	0.15	0.8	0.85	0.12	0.01	0.003	0.0009	0.0015	0.0004	-

Fig. 1

Table 2. Intermetallic Phases in New Alloys

Alloy	Phase Composition
Example 1	Mg-Al _{ss} , Al ₂ (Sr, Ca) ₁ , Al _x (Mn, RE) _y
Example 2	Mg-Al _{ss} , Al ₂ (Sr, Ca) ₁ , Al _x (Mn, RE) _y
Example 3	Mg-Al _{ss} , Al ₂ (Sr, Ca) ₁ , Al _y (Mn, RE) _y
Example 4	Mg-Al _{ss} , Al ₂ (Sr, Ca) ₁ , Al ₂ (Sr, Ca, RE) ₁ , Al _y (Mn, RE) _y
Example 5	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr) ₁₂ , Al ₂ Ca _{0.5} Sr _{0.5} , Al ₈ (Mn, RE) ₅
Example 6	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₈ (Mn, RE) ₅ , (Al, Zn) ₂ Ca _{0.5} Sr _{0.5}
Example 7	Mg-Al _{ss} , Mg ₁₇ Al ₉ Ca ₉ Sr, Al ₂ Ca _{0.5} Sr _{0.5} , Al ₈ (Mn, RE) ₅
Example 8	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₈ (Mn, RE) ₅ , (Al, Zn) ₂ Ca _{0.5} Sr _{0.5}
Example 9	Mg-Al _{ss} , Mg ₁₇ Al ₉ Ca ₂ Sr, Al ₂ Ca _{0.5} Sr _{0.5} , Al ₈ (Mn, RE) ₅
Example 10	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₈ (Mn, RE) ₅ , (Al, Zn) ₂ Ca _{0.8} Sr _{0.2}
Example 11	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr) ₁₂ , Al ₂ Ca _{0.8} Sr _{0.2} , Al ₈ (Mn, RE) ₅
Example 12	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₂ (Ca, RE) ₂ , Al ₈ (Mn, RE) ₅
Example 13	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₈ (Mn, RE) ₅ , (Al, Zn) ₂ (Ca, Sr) ₁
Example 14	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₈ (Mn, RE) ₅ , (Al, Zn) ₂ Ca _{0.5} Sr _{0.5}
Comparative example 1	Mg-Al _{ss} , Mg ₁₇ (Al, Zn) ₁₂ , Al ₈ Mn ₅
Comparative example 2	Mg-Al _{ss} , Al ₁₁ RE ₃ , Al ₁₀ RE ₂ Mn ₇
Comparative example 3	Mg-Al _{ss} , Al ₂ (Ca, Sr) ₁ , Al _y (Mn, RE) _y
Comparative example 4	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr, Zn) ₁₂ , Al ₈ (Mn, RE) ₅ , (Al, Zn) ₂ (Ca, Sr) ₁
Comparative example 5	Mg-Al _{ss} , Mg ₁₇ (Al, Ca, Sr) ₁₂ , Al ₂ (Ca, Sr) ₁ , Al ₈ (Mn, RE) ₅

Fig. 2

Table 3. Die Castability Properties

Alloy	Casting temperature [°C]	Oxidation Resistance	Fluidity	Die Sticking	Rank
Example 1	690	9.5	9	8.5	88
Example 2	690	9.5	9	9	91
Example 3	680	10	10	9.5	96
Example 4	690	9.5	9	9	92
Example 5	680	10	10	10	100
Example 6	660	10	8.5	9	91
Example 7	670	10	10	10	100
Example 8	660	10	9	9.5	95
Example 9	670	10	10	10	100
Example 10	680	10	10	9	93
Example 11	670	10	10	9.5	97
Example 12	670	10	10	9	93
Example 13	670	10	10	9	90
Example 14	660	10	9	9	92
Comparative Example 1	670	9.5	10	10	99
Comparative Example 2	690	8	8	9	80
Comparative Example 3	700	8	8	6	67
Comparative Example 4	670	10	10	7	80
Comparative Example 5	660	10	10	7	80

Fig. 3

Table 4. Mechanical Properties and Creep Behavior

Alloy	TYS [MPa]		UTS [MPa]	E%	CYS [MPa]		MCR. 10^9 [S ⁻¹]		CR mg/cm ² /day
	20°C	150°C			20°C	150°C	135°C 85 MPa	150°C 50 MPa	
Example 1	145	112	250	10	144	112	1.8	1.1	1.48
Example 2	145	108	244	10	147	105	1.9	1.2	1.45
Example 3	153	116	249	9	152	118	13.6	3.2	1.40
Example 4	153	130	253	8	155	132	1.4	1.1	0.86
Example 5	166	135	275	10	167	130	4.8	1.1	1.24
Example 6	164	125	272	8	165	125	5.9	1.8	1.27
Example 7	172	140	275	8	171	138	7.1	1.5	1.01
Example 8	175	130	272	6	174	130	8.6	2.2	1.12
Example 9	178	142	262	5	178	140	6.9	1.8	0.93
Example 10	175	120	260	5	174	122	11.8	2.7	1.21
Example 11	174	121	259	5	174	122	9.4	2.5	0.98
Example 12	164	115	252	6	166	112	12.1	2.9	1.08
Example 13	178	135	260	4	177	122	7.2	1.9	0.95
Example 14	182	122	266	4	181	138	11.5	2.5	1.03
Comparative Example 1	160	105	260	6	160	105	305	61	1.31
Comparative Example 2	135	100	240	12	135	100	12.4	2.2	1.62
Comparative Example 3	143	108	235	8	142	108	7.8	2.2	1.56
Comparative Example 4	182	138	238	1	181	137	12.2	2.3	1.41
Comparative Example 5	180	141	232	1	179	142	8.3	2.1	1.43

Fig. 4

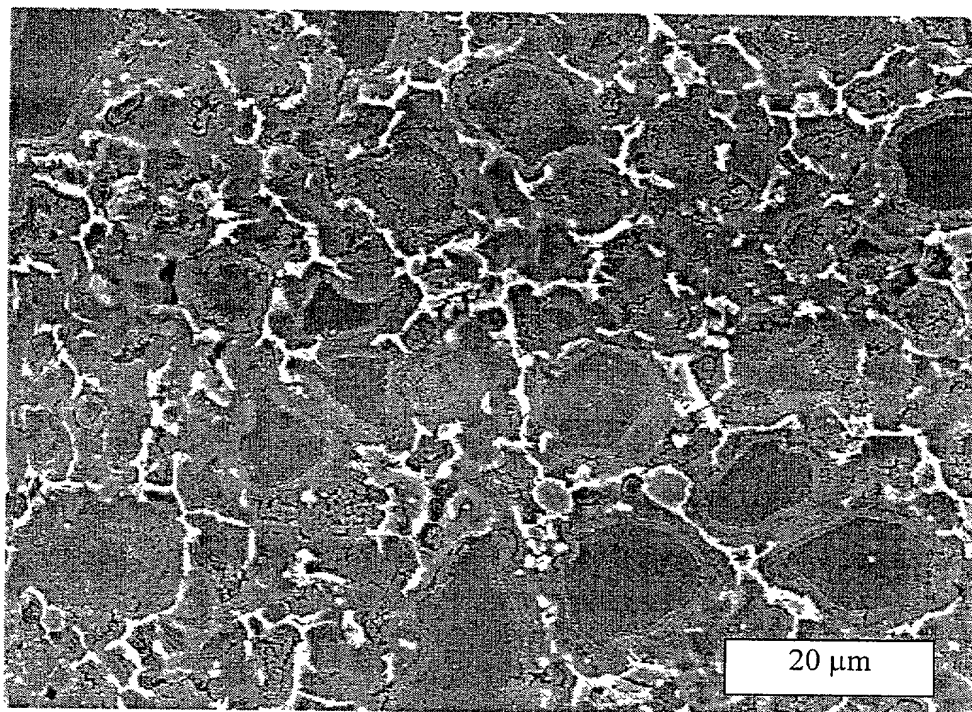


Fig. 5A

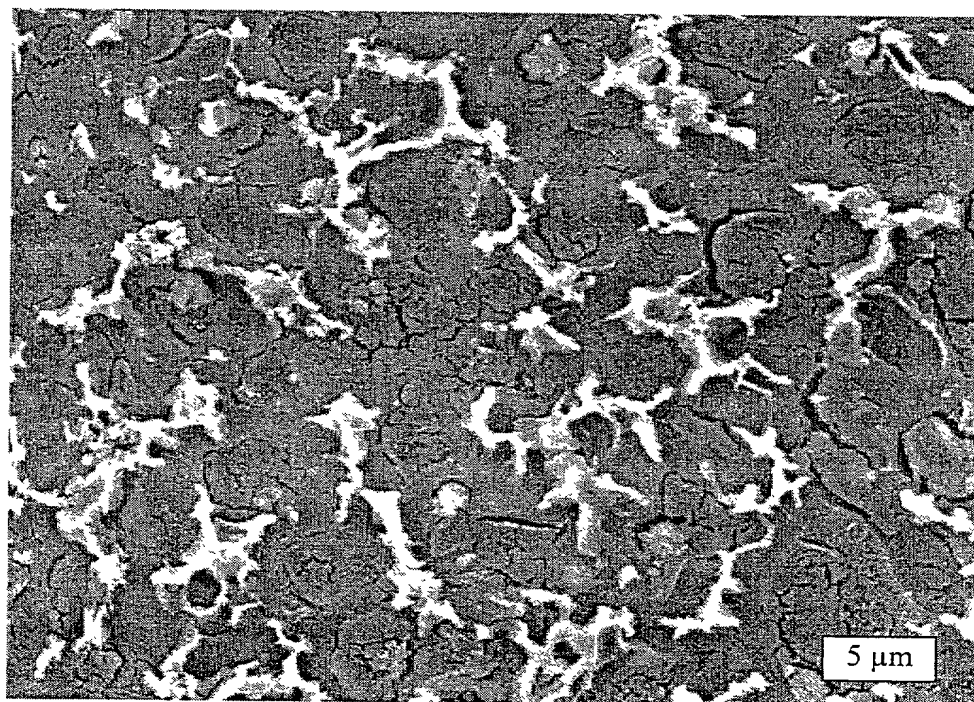


Fig. 5B

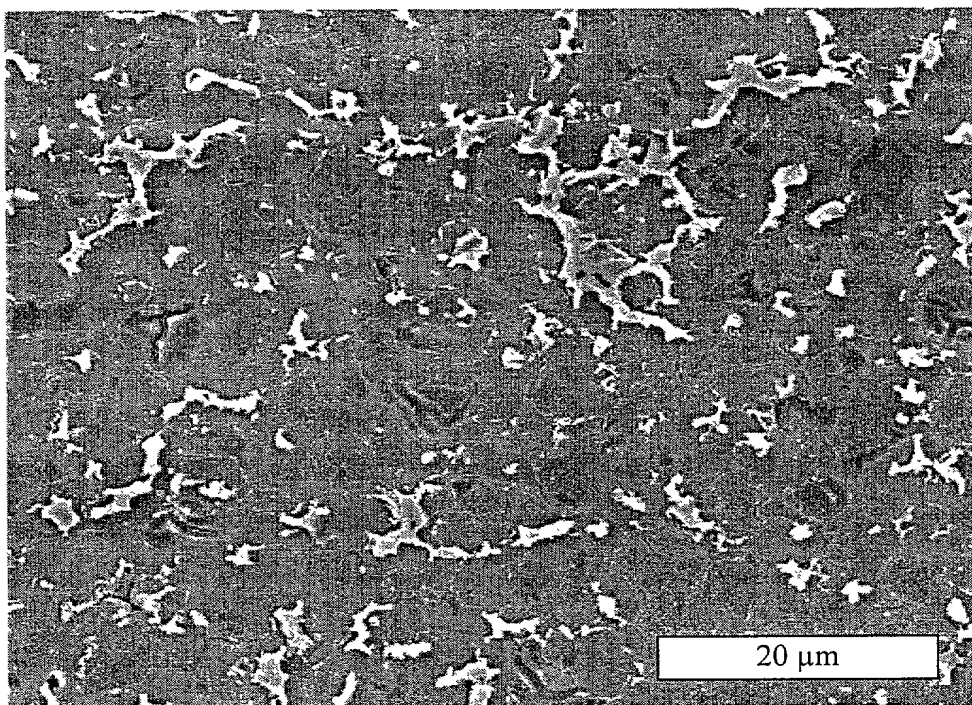


Fig. 6A

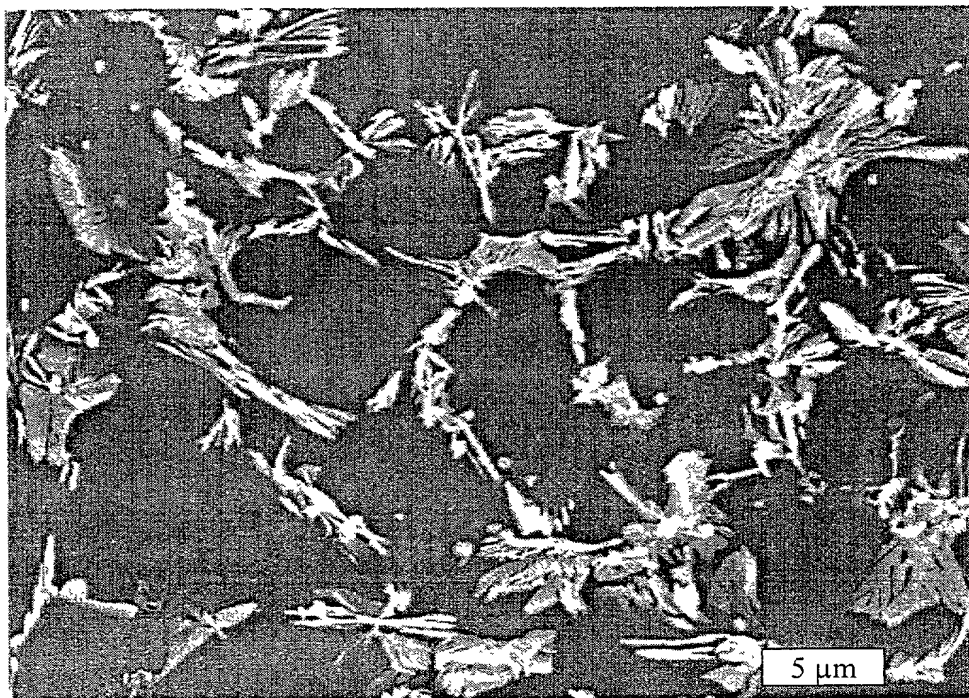


Fig. 6B